

# “JetIQ electronic ecosystem at the service of the university in the country that has undergone armed aggression”

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## SPECIAL ISSUE: ACADEMIC MANAGEMENT IN THE CONDITIONS OF WAR

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# JETIQ ELECTRONIC ECOSYSTEM AT THE SERVICE OF THE UNIVERSITY IN THE COUNTRY THAT HAS UNDERGONE ARMED AGGRESSION

## Abstract

The development of modern technologies and innovations provides opportunities for higher education institutions (HEIs) and directly for teachers and students to voluntarily use tools for distance and mixed learning. However, remote access in a pandemic or a state of war is necessity and has no alternatives.

The purpose of this study is to determine the role of the JetIQ electronic ecosystem for Vinnytsia National Technical University (VNTU) in wartime conditions. As in all HEI of Ukraine, the educational process at VNTU changed significantly during the year of military aggression. The need for students and teachers to hide in bomb shelters during air raids, frequent and, most importantly, unexpected interruptions of the educational process, and significant complications of access to laboratory equipment negatively affect the psychological state of all participants in educational activities. In these conditions, the JetIQ electronic ecosystem brought substantial benefits and became the primary tool for the management of the educational activities at VNTU. Reliable technological support also improved the psychological confidence of students and teachers. A comparison of the interim indicators of the 2022/2023 academic year with the trends of the three previous academic years in terms of quantitative indicators of educational resources and actions of all groups of JetIQ users showed positive trends. This testifies to its stability in the conditions of martial law.

## Keywords

Ukraine, war, electronic ecosystem, educational activity,  
JetIQ, VNTU, academic management, indicators

## JEL Classification

C89, H56, I20

## INTRODUCTION

In the conditions of the war, the academic management of Ukraine changed significantly, especially in those higher education institutions greatly affected by the aggression of Russia and/or forced to relocate to other safer territories. Although Vinnytsia National Technical University (VNTU) was practically unaffected by enemy shelling and remains in relatively stable conditions, the general situation in the country affects the psychological characteristics of the contingent of education seekers, the composition of scientific and pedagogical staff, available educational and auxiliary areas, means of communication, etc.

In these circumstances, the remote form of education should be accompanied with the tools of a single integrated learning management ecosystem and support of the educational institution's methodical, scientific, and managerial activities. Therefore, a new experience in managing the academic activity of VNTU, particularly ensuring its sustainability based on the use of JetIQ's electronic ecosystem (Dong

et al., 2009), is relevant. It can be helpful for all higher education institutions in Ukraine (Kvyetnyy et al., 2022). Although the integrated electronic ecosystem JetIQ VNTU has changed, but it has an innovative development vector that will affect the academic management of the university.

Therefore, the aim of the study is to determine the role of the JetIQ electronic ecosystem in the educational activities of Vinnytsia National Technical University in wartime conditions.

## 1. RESULTS

### 1.1. Development of JetIQ academic management tools at VNTU

VNTU comprises seven educational and scientific faculties. A team of highly qualified scientific and pedagogical staff trains students, postgraduates, and doctoral students: 72 full-time professors and 77 doctors of sciences, 200 associate professors, and about 300 candidates of sciences. The university prepares specialists using full-time and part-time modes in 28 bachelor's, 22 master's, and 21 Ph.D. specialties (Vinnytsia National Technical University, n.d.). About 5000 students study at VNTU. This puts the university in the middle group regarding the number of students in higher education institutions in Ukraine. The university has eight educational and laboratory buildings, which are located in two complex groups. Near them are located six dormitories – this reduces inappropriate student movements during classes.

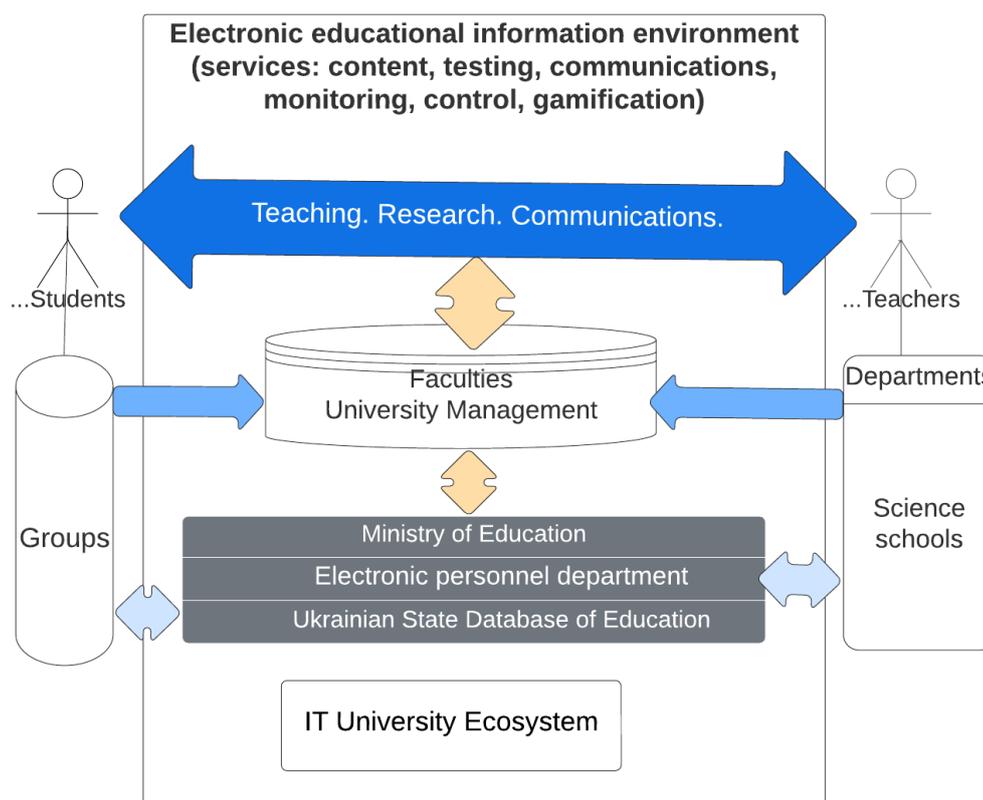
The management of VNTU aimed not only to develop the material and technical base of the university but also to improve its academic management. Digitization of the relevant toolkit received a significant boost in 2015 starting with the project to build the electronic university of VNTU. The concept of methodological and institutional support to develop an electronic university includes the principles of targeting the main active participants of the ecosystem according to the following priorities: a student, a teacher, management (managers of various levels), a researcher, and an employee. The concept includes:

- optimization of educational processes by minimizing paper documentation and reduction of time for generating reports;
- constant monitoring of educational processes using the quality indicators of educational services and teachers' qualifications;

- digitalization of all procedures concerning all training, scientific, methodical, and managerial activities.

On February 24, 2022, the educational activities at VNTU suddenly subsided because of the war. Technologies and innovations allow teachers and students to voluntarily use tools of distance and mixed learning; remote access in war conditions has become urgent and forced with no alternatives. In such stressful situations, remote education should be accompanied with the tools of a single integrated ecosystem supporting the educational, methodical, scientific, and managerial activities of the university. This approach allows users of such an electronic educational ecosystem to get remote access to information on various requests (not only from the educational process but also to work with documents), communicate with teachers and the dean's office, and other students, receiving various information about the activities provided by higher education institutions.

An unexpected shock in martial law created an environment of panic and the senselessness of any activities. However, the electronic learning environment, the support of the community of teachers and students, and the availability of not only Internet communications but also joint learning and communication made it possible to step-by-step perform a variety of learning tasks: communicate with teachers, students, curators and understand the meaning of life and opportunities to continue it in new unusual and scary conditions. Even almost "black" jokes in classes about anxiety, shelling, and pride for Ukrainians supported the spirit and desire to live and develop, to have hope for a future peaceful life. These helped the university community to live and stay strong. The content of the courses and the lecture material became more specific, got rid of unnecessary theoretical subtleties and unnecessary discussions, and practical examples also received a "military overtone."



**Figure 1.** The structure of the JetIQ electronic ecosystem of VNTU

Work process immersion made it possible to overcome stress and set up a discussion with students concerning endurance in unusual conditions, remote work, and online learning. All of this raised the spirits of all participants in the educational process. The defined principles and functions of the JetIQ electronic ecosystem have come in handy (Kvyetnyy, 2017), as they provide for the most optimized procedures of educational processes and electronic communications of the student-teacher dimension by other participants of the ecosystem (Nguyen & Tuamsuk, 2022). Active feedback from the users impeded the entire system's further development (Kovalenko & Palamarchuk, 2018). Despite the harsh conditions of the war, departments of methodical and technical support of the electronic ecosystem adapted the modules "Electronic Dean's Office" and "Electronic Document Management" and motivated applicants and teachers to use these tools. The university's technical staff conducted research focused on improving the functionality and reliability of the system, in particular, on transferring it to a microservice architecture.

An essential and valuable aspect in wartime is ecosystem contingency with external educational information systems (distance learning platforms, Unified State Database of Education (USDE) system, websites of employers, partners, etc. – Figure 1). The ecosystem becomes practical and psychologically comfortable when adapted to an educational institution's established traditions, structure, and regulatory framework (Palamarchuk et al., 2022).

A unified communication system was optimized: minimum number of channels was used to obtain the necessary information in a comfortable environment. Mobile and web applications within a single interface are actively being created. In particular, the data of the electronic ecosystem are formed from official sources and created by its participants. At the same time, each system user produces his or her data (as a rule, they are unique). The participant is responsible for these data by the job description or activity form. For example, the student's Personal Cabinet is a structured subsystem of JetIQ (the core of all JetIQ information resources). It provides learning in synchronous

and asynchronous modes, self-monitoring of academic performance, gamification elements and offers a communication channels (Bisikalo et al., 2019). JetIQ's microservice architecture also supports such modules as the Teacher's Cabinet; The Electronic Dean's Office, which is connected with the autonomous LoD system (LoD is responsible for reliable and error-free data exchange with USDE system); Electronic class schedule; Repository, Electronic library; TestIQ knowledge testing system; Electronic archive of course projects and term papers; Personnel department, etc.

At the beginning of the quarantine period introduced due to the COVID-19 pandemic (March 2020), six out of seven faculties and two institutes already worked in the JetIQ system. Therefore, VNTU entered the phase of full-distance education relatively quickly compared to other universities in Ukraine. This gave the university significant experience working in the distance learning format (Chandio, 2020). Unfortunately, this experience was not only positive but also negative (Kovalenko et al., 2021).

Many problems were not observed in the preparatory period when the university used blended learning. In particular, there was a need to finalize individual JetIQ modules and develop new ones, as well as to optimize the network and server infrastructure of VNTU to work under conditions of a challenging environment. It also turned out that specific problems of teachers and students were not so much technical as psychological. Therefore, such a situation required considerable explanatory work among all categories of stakeholders. There was also a need to create a friendly atmosphere among the educational process participants and eliminate certain shortcomings of the JetIQ system (i.e., make it user-friendly and more accessible).

## 1.2. Analysis of the sustainability of VNTU educational activity during the war based on data from the JetIQ system

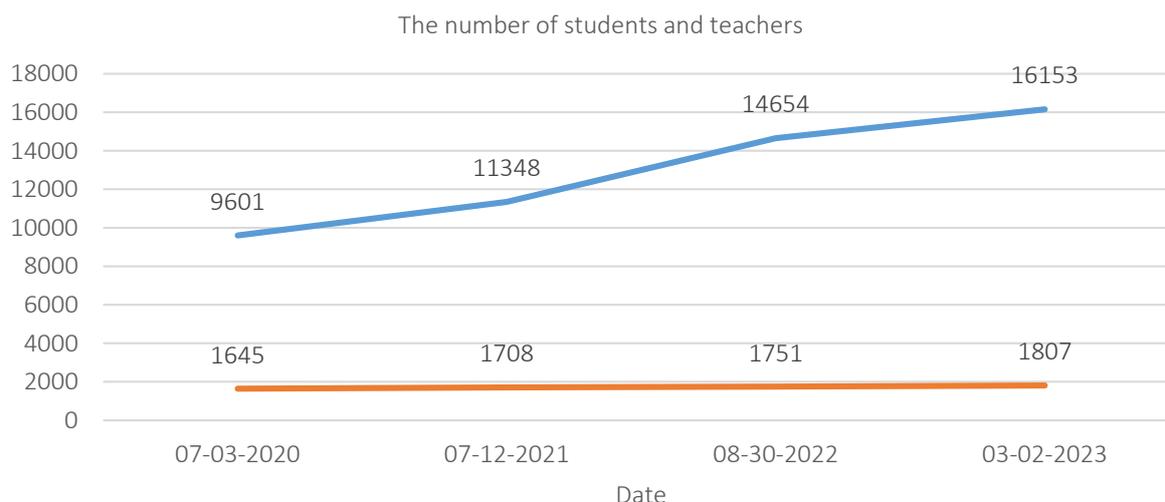
Before the start of full-scale military aggression, most universities in Ukraine already had experience in e-learning, particularly in imple-

menting certain electronic educational systems. The general trend was to use the free version of Moodle as a basic educational platform with additional self-developed modules without a comprehensive approach to integration with all HE processes (Deacon et al., 2023). This approach was used by National Technical University of Ukraine "Kyiv Polytechnic Institute named after Igor Sikorsky," National University of Life and Environmental Sciences of Ukraine, Borys Grinchenko Kyiv University, Vasyl' Stus Donetsk National University, Ternopil Ivan Puluj National Technical University, Sumy National Agrarian University, Khmelnytskyi National University, Vinnytsia Institute of Trade and Economics of Kyiv National University of Trade and Economics, Kharkiv National University of Radio Electronics, Kharkiv National Automobile and Highway University, Lviv Polytechnic National University, "Krok" University, and many others.

National Technical University "Kharkiv Polytechnic Institute" was the first in Ukraine to implement electronic means of mixed and distance learning ("Web-class KhPI" (since 2001), "SIM Information Management System" (since 2004), although Moodle is currently also used. Vinnytsia National Agrarian University uses the "Socrates" system, and Sumy State University created its own distance learning platform. In particular, the most developed of the given examples is the system of Sumy State University. It consists of several educational subsystems, united for students and teachers by one common login through their account. However, all these subsystems exist separately and are supported by different teams.

Therefore, the fundamental difference between the JetIQ electronic ecosystem of VNTU and the approaches to applying separate educational subsystems is the presence and consistent development of a unified integrated architecture (Palamarchuk, 2021).

During the year of the full-scale war, the staff of VNTU (academic and service personnel) stayed the same, with a relatively small decrease in funding from the Ministry of Education and Science of Ukraine and other sources. On the other hand, the contingent of students and postgraduates increased. However, from a psychological point of



**Figure 2.** A contingent of education seekers and non-professionals registered in the JetIQ system

view, the war affected both mental state and the performance of each teacher and student (Lavrysh et al., 2022).

It is currently quite problematic to assess the impact of the negative factors of the military state on the quality of educational activities (Spirin, 2013) because such an assessment requires time and additional research. However, certain conclusions can be drawn about the sustainability of the educational activity at VNTU.

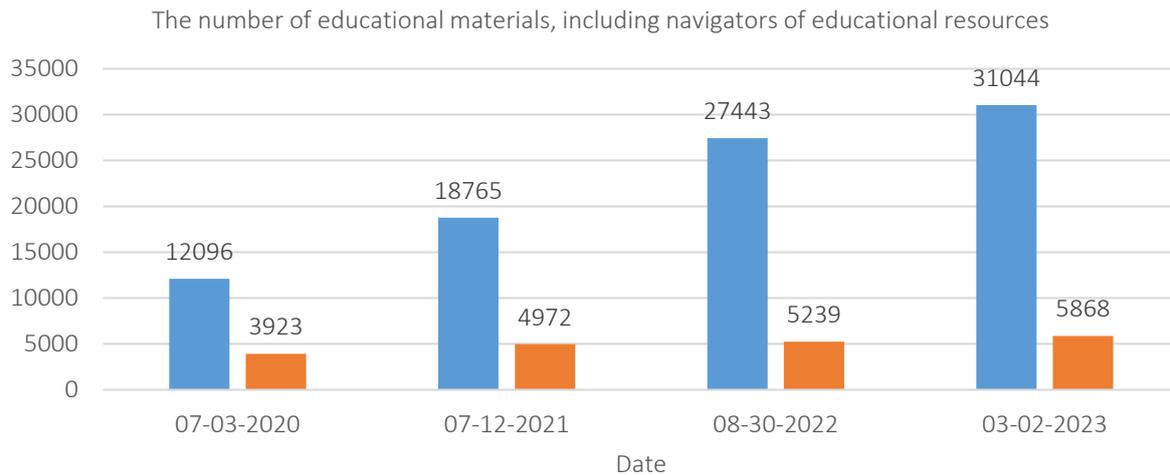
All available internal indicators of the JetIQ electronic ecosystem over the past years were analyzed. From them, the following indicators (Table A1 in Appendix A) were singled out, directly related to the educational activities and indicators associated with the quality of education. Typically, JetIQ accumulates indicator values for an academic year. This is reflected in the first three columns of the “Date” item. That is, data for the 2019/2020 academic year (before the start of the COVID-19 pandemic), 2020/2021 (the initial year when the strict lockdown started), and 2021/2022 (the continuation of the COVID-19 pandemic and the beginning of Russian attack on Ukraine) are shown here. The current 2022/2023 academic year is ongoing, so the fourth column indicates only interim data as of March 2, 2023. These values will definitely increase by the end of the second semester.

Table A1 shows a clear upward trend in absolutely all indicators of the educational activity of VNTU in the three pre-war academic years. This applies to

the indicators characterizing the users of the system, its key resources (including repositories and indicators of professional activity of academic personnel), as well as data from electronic dean’s offices, electronic class schedules, and mobile applications of students and teachers. This positive trend is explained by two main reasons. The first is the completion of the period of coverage of the JetIQ electronic ecosystem of all educational and scientific units of VNTU. The second relates to the previously mentioned need for a complete transition to the online mode of the educational process due to the introduction of a blanket lockdown in Ukraine (Chen et al., 2023). Thus, there is every reason to claim that at the beginning (and amid the war) of the 2022/2023 academic year, the JetIQ electronic ecosystem has become the primary tool used to manage the educational activities of VNTU.

Given the purpose of the study, more important is the comparison of the intermediate indicators of the current 2022/2023 (“military” academic year) with the trends of the three previous academic years. Figure 2 reflects an actual increase in the enrollment of VNTU students in 2022 for both bachelor’s and master’s degrees. This is characteristic of the majority of the country’s higher education institutions during the war. Accordingly, in proportion to the contingent of students, a 3.2% increase in VNTU teachers was recorded (Figure 2).

According to the quantitative indicators of educational resources involved in the educational activities of VNTU, positive trends are also generally



**Figure 3.** The number of educational materials and navigators of educational resources in the JetIQ system

observed, which characterizes the effectiveness of academic management in martial law conditions. For example, Figure 3 shows a 13.1% increase in learning materials and a 12% increase in academic discipline navigators during six months of the current 2022/2023 academic year, despite the challenges of war.

The overall analysis of data shows the absence of a decline in the indicators of the educational activity of VNTU during the war. This is confirmed by:

- the existing tendency to increase scientific publications and signs of academics staff professional activity (CVs of teachers and their certificates of professional development),
- electronic educational and examination tests (TestIQ), information and evaluations in the Electronic Dean's Office,
- documents in the general repository of the university,
- the number of mobile applications users.

Separately, it is necessary to mention the indicator of the number of classes in the generally stable category of formal features of the electronic schedule. The lower number of classes entered into the JetIQ system is caused precisely by the incompleteness of the current academic year. In particular, the faculties of VNTU will still enter data on the schedules of the sessions of correspondence education applicants.

Different conclusions can be drawn when analyzing the seemingly formal indicator "answers to questions received in the electronic knowledge testing system TestIQ (since the beginning of the academic year)." The decrease in answers to the tests by more than half (52.8%) can be partially explained by:

- 1) massive power outages in Vinnytsia region in the autumn semester as a result of massive rocket attacks by the aggressor on the critical energy infrastructure of Ukraine,
- 2) data during only 6 out of 10 months of this academic year were obtained.

It is worth taking into account that the absolute majority of TestIQ training tests are performed in a training mode. Therefore, repeated passing of a particular test indicates how faithfully the students study in the distance mode. Such a significant decrease in the number of answers to the questions of electronic tests indicates a noticeable decline in the motivation of students to study in the conditions of war. This is also confirmed by surveys conducted at VNTU. It was determined that the main problems are emotional burnout and decreased motivation (Ma et al., 2022). This leads to the stratification of the student contingent, which is characterized by a decrease in the specific share of students with excellent grades and an increase in the percentage of students who have debts from academic disciplines.

Therefore, regardless of a certain indirectness of the indicators of the JetIQ ecosystem used for the analysis, the sustainability of the educational activity of VNTU in the conditions of war can be justified. Of course, assessing the quality of the educational process during the war requires unique research. Still, it is already clear that to solve the problem of negative stratification of the contingent of education seekers, it is necessary to find new ways to increase students' motivation, notably by introducing gamification approaches (Mohamed Hashim et al., 2022).

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## CONCLUSION

The purpose of this study was to determine the role of the JetIQ electronic ecosystem in the educational activities of Vinnytsia National Technical University in wartime conditions. The VNTU educational process has changed significantly during the year of military aggression. There were frequent and, importantly, unexpected interruptions of the educational process because of air raids, when students and teachers had to hide in bomb shelters. There were also communications problems due to the energy infrastructure damage following the bombings. In addition, access to educational and laboratory equipment has become much more difficult. As in any other higher education institutions of Ukraine, all these factors negatively affect the psychological state of all participants in educational activities.

However, these challenges strengthen the community of teachers and students through reliable support of learning processes and communications. The educational philosophy has also changed when it is necessary to perform various learning tasks step by step, communicate with teachers, students, and curators and understand the true meaning of life and the possibilities to move on in new, unusual, and scary circumstances.

Reliable technological support also improved the psychological confidence of both students and university teachers. The findings indicated an upward trend when comparing interim indicators of the current 2022/2023 academic year with the trends of the three previous academic years in terms of quantitative indicators of educational resources and actions of all groups of JetIQ users participating in the educational activities of VNTU. This proved its stability in the conditions of martial law. In particular, despite the challenges of the war, the ecosystem recorded a 13.1% increase in educational materials and a 12% increase in academic discipline navigators within six months of the current 2022/2023 academic year.

Although the indicators of the course of the educational activity are to some extent indirect, the study revealed the negative stratification of the contingent of education seekers due to a noticeable decrease in their motivation to study.

## AUTHOR CONTRIBUTIONS

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Formal analysis: Oleh Bisikalo, Roman Kvyetnyy.

Funding acquisition: Roman Kvyetnyy, Volodymyr Storchak.

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Writing – original draft: Oleh Bisikalo, Yevhen Palamarchuk, Volodymyr Storckhak.

Writing – review & editing: Oleh Bisikalo, Yevhen Palamarchuk.

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## APPENDIX A

**Table A1.** Protocol indicators of the JetIQ electronic system, which characterize the educational activity of VNTU

Indexes	Date			
	July 3, 2020	July 12, 2021	August 30, 2022	March 2, 2023
<b>Users</b>				
Students	9601	11348	14654	16153
Student groups	889	2483 (with gr. select. disc.)	2212 (with gr. select. disc.)	2212 (564)
Teachers/employees	1645	1708	1751	1807
<b>Resources</b>				
Educational materials	12096	18765	27443	31044
Scientific publications	29641	32194	37088	38390
Navigators of educational resources	3923	4972	5239	5868
TestIQ electronic tests	2992	4499	5378	5897
Answers to questions of TestIQ (since the beginning of the academic year)	4084820	4463799	4805672	2271750
<b>Electronic dean's office</b>				
Documents	25206	40809	54766	61118
Scores	241809	378728	517532	603648
<b>Electronic class schedule</b>				
Classes	39396	49830	73027	70773
Auditorium	412	454	466	468
Faculties	9	9	9	9
<b>Repositories</b>				
Documents and methodological works	1377	2498	4468	5268
Scientific papers	26965	29881	32374	32944
<b>Professional activity (participants)</b>				
CVs			459	471
Certifications on advanced training			437	452
<b>Mobile applications (users)</b>				
JetIQ Student	2497	3706	4781	6140
JetIQ Teacher	131	164	189	213